

## CLAIMS

1. (Currently amended) A phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound comprising either (i) mono- or poly-alkylene oxide linking groups between the phosphorus and the fluorocarbon group, or (ii) no linking group between the phosphorus and fluorocarbon group, or (iii) individual mixtures of (i) and (ii); said compound does not contain an aryl or arylene group; and said fluorocarbon group is said perfluoropolyether or perfluoroalkyl group.

2. (Original) A compound according to claim 1 comprising a mono- or poly-alkylene oxide linking groups between the phosphorus and the fluorocarbon group.

3. (Currently amended) A compound according to claim 2 wherein  
said compound is Formula IA disclosed in the specification has the formula of  
[Rf-Y-]<sub>(3-y)</sub>P(E)<sub>b</sub>[-Y-Rf<sup>1</sup>]<sub>y</sub>;

Rf is a polyether chain having a formula weight ranging from 400 to 15,000  
and composed of repeating units selected from the group consisting of:

(a) J-O-(CF(CF<sub>3</sub>)CF<sub>2</sub>O)<sub>c</sub>(CFXO)<sub>d</sub>CFZ, (b) J<sup>1</sup>-O-(CF<sub>2</sub>CF<sub>2</sub>O)<sub>e</sub>(CF<sub>2</sub>O)<sub>f</sub>CFZ<sup>1</sup>,  
(c) J<sup>2</sup>-O-(CF(CF<sub>3</sub>)CF<sub>2</sub>O)<sub>j</sub>CF(CF<sub>3</sub>), (d) J<sup>3</sup>-O-(CQ<sub>2</sub>-CF<sub>2</sub>CF<sub>2</sub>-O)<sub>k</sub>-CQ<sub>2</sub>-CF<sub>2</sub>-,  
(e) J<sup>4</sup>-O-(CF<sub>2</sub>CF<sub>2</sub>O)<sub>l</sub>CF<sub>2</sub>-, (f) J<sup>3</sup>-O-(CF(CF<sub>3</sub>)CF<sub>2</sub>O)<sub>g</sub>(CF<sub>2</sub>CF<sub>2</sub>O)<sub>h</sub>(CFX-O)<sub>i</sub>-CFZ-, and  
(g) mixtures of two or more thereof and the units with formulae CF<sub>2</sub>CF<sub>2</sub>O and CF<sub>2</sub>O  
are randomly distributed along the chain;

J is a fluoroalkyl group selected from the group consisting of CF<sub>3</sub>, C<sub>2</sub>F<sub>5</sub>, C<sub>3</sub>F<sub>7</sub>,  
CF<sub>2</sub>Cl, C<sub>2</sub>F<sub>4</sub>Cl, C<sub>3</sub>F<sub>6</sub>Cl, or mixtures of two or more thereof;

J<sup>1</sup> is a fluoroalkyl group selected from the group consisting of CF<sub>3</sub>, C<sub>2</sub>F<sub>5</sub>,  
CF<sub>2</sub>Cl, and C<sub>2</sub>F<sub>4</sub>Cl;

J<sup>2</sup> is C<sub>2</sub>F<sub>5</sub> or C<sub>3</sub>F<sub>7</sub>;

J<sup>3</sup> is selected from the group consisting of CF<sub>3</sub>, C<sub>2</sub>F<sub>5</sub>, and C<sub>3</sub>F<sub>7</sub>;

J<sup>4</sup> is CF<sub>3</sub> or C<sub>2</sub>F<sub>5</sub>;

c and d are numbers such that the c/d ratio ranges from 0.01 to 0.5, and the  
formula weight ranges from 400 to 15,000;

e and f are numbers such that the e/f ratio ranges from 0.3 to 5, and the  
formula weight is from 400 to 15000;

g, h and i are numbers such that (g + h) ranges from 1 to 50, the i/(g + h) ratio  
ranges from 0.1 to 0.05, and the formula weight is from 400 to 15,000;

j is a number such that the formula weight ranges from 400 to 15,000;  
k is a number such that the formula weight ranges from 400 to 15,000;  
l is a number such that the formula weight ranges from 400 to 15,000;  
each Q is independently F, Cl, or H;  
b is zero or 1;  
E is oxygen or sulfur;  
Rf<sup>l</sup> is Q-(C<sub>m</sub>F<sub>2m</sub>)- representing a monovalent branched or straight chain  
polyfluoroalkyl group;  
m has a value from 1 to 20;  
X is -F, -CF<sub>3</sub>, or mixtures thereof;  
y is 0.05 to 2;  
Y is (CH<sub>2</sub>)<sub>z</sub>O(CH<sub>2</sub>CH<sub>2</sub>O)<sub>z'</sub>;  
z is 1 to 4;  
z' is 0, 1 or 2;  
Z is -F, -Cl or -CF<sub>3</sub>;  
Z' is -F or -Cl.

4. (Currently amended) A compound according to claim 2 wherein said compound is ~~Formula IB disclosed in the specification~~ has the formula of [Rf-Y-]<sub>(3-y)</sub>P(E)<sub>b</sub>[-OCH(Rf<sup>l</sup>)<sub>2</sub>]<sub>y</sub>; and Rf, Y, y, E, b, and Rf<sup>l</sup> are as recited in claim 3.
5. (Currently amended) A compound according to claim 2 wherein said compound is ~~Formula II A disclosed in the specification~~ has the formula of [Rf<sup>l</sup>-Y-]<sub>2</sub>P(E)<sub>b</sub>[-Y- Rf<sup>2</sup>-Y-]P(E)<sub>b</sub>[-Y- Rf<sup>l</sup>]<sub>2</sub>;  
Rf<sup>l</sup>, Y, E, and b are as recited in claim 3;  
Rf<sup>2</sup> is a divalent perfluoropolyether chain segment that can have a number average formula weight of 500 to 15,000 and can be selected from the group consisting of (i) (CF<sub>2</sub>CF<sub>2</sub>O)<sub>e</sub>(CF<sub>2</sub>O)<sub>f</sub>CF<sub>2</sub>-, (ii) (C<sub>3</sub>F<sub>6</sub>O)<sub>p</sub>(CF<sub>2</sub>CF<sub>2</sub>O)<sub>q</sub>(CFXO)<sub>r</sub>CF<sub>2</sub>-, (iii) (CF<sub>2</sub>CF<sub>2</sub>O)<sub>k</sub>(C<sub>3</sub>F<sub>6</sub>O)<sub>l</sub>CF(CF<sub>3</sub>)-,  
(iv) CF(CF<sub>3</sub>)O(C<sub>3</sub>F<sub>6</sub>O)<sub>w</sub>-Rf<sup>3</sup>-O-(C<sub>3</sub>F<sub>6</sub>O)<sub>w</sub>CF(CF<sub>3</sub>)-, (v) ((CQ<sub>2</sub>)CF<sub>2</sub>CF<sub>2</sub>O)<sub>s</sub>CF<sub>2</sub>CF<sub>2</sub>, and mixtures of two or more thereof and the units with formulae CF<sub>2</sub>CF<sub>2</sub>O and CF<sub>2</sub>O are randomly distributed along the chain;

Rf<sup>3</sup> is linear or branched C<sub>a</sub>F<sub>2a</sub>;  
a is 3 to 30;  
e, f, k, and l are the same as recited in claim 3;

p, q and r are numbers such that (p+q) ranges from 1 to 50, and the r/(p+q) ratio ranges from 0.1 to 0.05, and the formula weight is from 400 to 15,000;

s is a number such that the formula weight ranges from 400 to 15,000; and w is independently 2 to 20.

6. (Currently amended) A compound according to claim 2 wherein said compound is ~~Formula II~~ disclosed in the specification has the formula of  $[(Rf^l)_2CHO-]_2P(E)_b[-Y-Rf^2-Y-]P(E)_b[-OCH(Rf^l)_2]_2$ ; and Rf<sup>l</sup>, E, b, Y, and Rf<sup>2</sup> are as recited in claim 5.

7. (Original) A compound according to claim 1 comprising no linking group between the phosphorus and fluorocarbon group.

8. (Currently amended) A compound according to claim 7 wherein said compound is ~~Formula III~~ disclosed in the specification has the formula of  $[(Rf]_{(3-y)}-P(E)_b[Rf^l]_y$ ; and Rf, y, E, b, and Rf<sup>l</sup> are the same as recited in claim 3.

9. (Currently amended) A compound according to claim 7 wherein said compound is ~~Formula IV~~ disclosed in the specification has the formula of  $[Rf^l]_2-P(E)_bRf^2-P(E)_b[Rf^l]_2$ ; and Rf<sup>l</sup>, E, b, and Rf<sup>2</sup>, are as recited in claim 5.

10. (Original) A compound according to claim 1 comprising only one mono-alkylene oxide or polyalkylene oxide linking group and having the proviso of (1) when said perfluoroether has a mono- or poly-alkylene oxide linking group, said fluoroalkyl has no linking group and (2) when said fluoroalkyl has a mono- or poly-alkylene oxide linking group, said perfluoroether has no linking group.

11. (Currently amended) A compound according to claim 10 wherein said compound is ~~Formula V~~ disclosed in the specification has the formula of  $[Rf-Y-]_{(3-y)}P(E)_b[Rf^l]_y$ ; and Rf, Y, y, E, b, and Rf<sup>l</sup> are the same as recited in claim 3.

~~13~~12. (Currently amended) A compound according to claim 10 wherein said compound is ~~Formula VI~~ disclosed in the specification has the formula of  $[Rf-]_{(3-y)}P(E)_b[-Y-Rf^l]_y$ ; and Rf, y, E, b, Y, and Rf<sup>l</sup> are the same as recited in claim 5.

~~14~~13. (Currently amended) A compound according to claim 10 wherein said compound is ~~Formula VII~~ disclosed in the specification has the formula of  $[Rf-Y-]_{(3-y)}P(E)_b[-OCH(Rf^l)_2]_y$ ; and Rf, Y, y, E, b, and Rf<sup>l</sup> are the same as recited in claim 3.

**1514.** (Currently amended) A compound according to claim 10 wherein said compound is ~~Formula VII disclosed in the specification~~ has the formula of  $[Rf^1]_2P(E)_b[-Y-Rf^2-Y]P(E)_b[Rf^1]_2$ ; and  $Rf^1$ ,  $E$ ,  $b$ ,  $Y$ , and  $Rf^2$  are the same as recited in claim 5.

**1615.** (Currently amended) A compound according to claim 10 wherein said compound is ~~Formula VIIIA disclosed in the specification~~ has the formula of  $[Rf^1-Y]_2P(E)_b[Rf^2]P(E)_b[-Y-Rf^1]_2$ ; and  $Rf^1$ ,  $Y$ ,  $E$ ,  $b$ , and  $Rf^2$  are the same as recited in claim 5.

**1716.** (Currently amended) A compound according to claim 10 wherein said compound is ~~Formula VIIIB disclosed in the specification~~ has the formula of  $[(Rf^1)_2-CHO]_2P_2(E)_b[Rf^2]P(E)_b[-OCH(Rf^1)_2]_2$ ; and  $Rf^1$ ,  $E$ ,  $b$ , and  $Rf^2$  are the same as recited in claim 5.

**1817.** (Original) A compound according to claim 1 wherein said compound is a partially esterified phosphate, a partially esterified phosphonate, a salt of a partially esterified phosphate, a salt of a partially esterified phosphonate, or mixtures of two or more thereof.

**1918.** (Original) A compound according to claim 1817 comprising a mono- or poly-alkylene oxide linking groups between the phosphorus and the fluorocarbon group.

**2019.** (Currently amended) A compound according to claim 1918 wherein said compound is ~~Formula IXA disclosed in the specification~~ has the formula of  $[Rf-Y]_{(3-x-y)}-P(E)-[-Y-Rf^1]_y[OM]_x$ ;  $Rf$ ,  $Y$ ,  $y$ ,  $E$ , and  $Rf^1$  are the same as recited in claim 3;  $x$  is 0.05 to 1; and  $M$  is hydrogen, alkali metal, alkaline earth metal, or ammonium.

**2120.** (Currently amended) A compound according to claim 1918 wherein said compound is ~~Formula IXB disclosed in the specification~~ has the formula of  $[Rf-Y]_{(3-x-y)}-P(E)-[-OCH-(Rf^1)_2]_y[OM]_x$ ; and  $Rf$ ,  $Y$ ,  $x$ ,  $y$ ,  $E$ ,  $Rf^1$ , and  $M$  are the same as recited in claim 19.

**2221.** (Currently amended) A compound according to claim 1918 wherein said compound is ~~Formula XA disclosed in the specification~~ has the formula of  $[MO]_x[Rf^1-Y]_{(2-x)}-P(E)[-Y-Rf^2-Y]P(E)[-Y-Rf^1]_{(2-x)}[OM]_x$ ;  $M$ ,  $x$ ,  $Rf^1$ ,  $E$ , and  $Y$  are the same as recited in claim 19; and  $Rf^2$  is the same as recited in claim 5.

2322. (Currently amended) A compound according to claim 1918 wherein said compound is ~~Formula XB disclosed in the specification has the formula of~~  $[MO]_x[(Rf^1)_2-CHO]_{(2-x)}P(E)[-Y-Rf^2-Y-]P(E)[-OCH-(Rf^1)_x]_{(2-x)}[OM]_x$ ; and M, x, Rf<sup>1</sup>, E, Y, and Rf<sup>2</sup> are the same as recited in claim 21.

2423. (Currently amended) A compound according to claim 1817 comprising no linking group between the phosphorus and fluorocarbon group.

2524. (Currently amended) A compound according to claim 1823 wherein said compound is ~~Formula XI disclosed in the specification has the formula of~~  $[Rf]_{(3-x-y)}-P(E)[-Rf^1]_y[OM]_x$ ; and Rf, x, y, E, Rf<sup>1</sup>, and M are the same as recited in claim 19.

2625. (Currently amended) A compound according to claim 1823 wherein said compound is ~~Formula XII disclosed in the specification has the formula of~~  $[MO]_x[Rf^1-]_{(2-x)}-P(E)Rf^2-P(E)[-Rf^1]_{(2-x)}[OM]_x$ ; and M, Rf<sup>1</sup>, x, E, M, and Rf<sup>2</sup> are the same as recited in claim 21.

2726. (Currently amended) A compound according to claim 1817 comprising only one mono-alkylene oxide or polyalkylene oxide linking group and having the proviso of (1) when said perfluoroether has a mono- or poly-alkylene oxide linking group, said fluoroalkyl has no linking group and (2) when said fluoroalkyl has a mono- or poly-alkylene oxide linking group, said perfluoroether has no linking group.

2827. (Currently amended) A compound according to claim 2726 wherein said compound is ~~Formula XIII disclosed in the specification has the formula of~~  $[Rf-Y]_{(3-x-y)}P(E)[-Rf^1]_y[OM]_x$ ; and Rf, Y, Rf<sup>1</sup>, x, y, E, and M are the same as recited in claim 19.

2928. (Currently amended) A compound according to claim 2726 wherein said compound is ~~Formula XIV A disclosed in the specification has the formula of~~  $[Rf]_{(3-x-y)}P(E)[-Y-Rf^1]_y[OM]_x$ ; and Rf, x, y, E, Y, Rf<sup>1</sup>, and M are the same as recited in claim 19.

3029. (Currently amended) A compound according to claim 2726 wherein said compound is ~~Formula XIV B disclosed in the specification has the formula of~~  $[Rf]_{(3-x-y)}P(E)[-OCH-(Rf^1)_2]_y[OM]_x$ ; and Rf, Rf<sup>1</sup>, x, y, E, and M are the same as recited in claim 19.

**3130.** (Currently amended) A compound according to claim 2726 wherein said compound is ~~Formula XV disclosed in the specification has the formula of~~  $[MO]_x[Rf^1]_{(2-x)}P(E)[-Y-Rf^2-Y]P(E)[-Rf^1]_{(2-x)}[OM]_x$ ; and M, Rf<sup>1</sup>, x, E, Y, and Rf<sup>2</sup> are the same as recited in claim 21.

**3231.** (Currently amended) A compound according to claim 2726 wherein said compound is ~~Formula XVI disclosed in the specification has the formula of~~  $[MO]_x[Rf^1-Y]_{(2-x)}P(E)[-Rf^2]P(E)[-Y-Rf^1]_{(2-x)}[OM]_x$ ; and M, Rf<sup>1</sup>, x, E, Y, and Rf<sup>2</sup> are the same as recited in claim 21.

**3332.** (Currently amended) A compound according to claim 2726 wherein said compound is ~~Formula XVIB disclosed in the specification has the formula of~~  $[MO]_x[Rf^1-CHO]_{(2-x)}P(E)[-Rf^2]P(E)[-OCH-(Rf^1)_2]_{(2-x)}[OM]_x$ ; and M, Rf<sup>1</sup>, x, E, Y, and Rf<sup>2</sup> are the same as recited in claim 21.

**3433.** (Currently amended) A composition comprising a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound and optionally a thickener wherein said compound is the same as that disclosed in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, or 32 one of Formulae IA to XVIB disclosed in the specification.

**[[35]]34.** (Currently amended) A composition according to claim [[34]]33 wherein said compound is a partially esterified phosphate, a salt of a partially esterified phosphate, or mixtures thereof.

**[[36]]35.** (Currently amended) A composition according to claim [[34]]33 wherein said compound is a partially esterified phosphonate, a salt of a partially esterified phosphonate, or mixtures thereof.

**[[37]]36.** (Currently amended) A composition according to claim [[34]]33 where said thickener is polytetrafluoroethylene.

**[[38]]37.** (Currently amended) A composition according to claim [[35]]34 where said thickener is polytetrafluoroethylene.

**[[39]]38.** A composition according to claim [[36]]35 where said thickener is polytetrafluoroethylene.

**4039.** (Currently amended) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing

compound recited in one of claims 1 to 39 as recited in claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, or 32.

40. (New) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound as recited in claim 33.

41. (New) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound as recited in claim 34.

42. (New) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound as recited in claim 35.

43. (New) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound as recited in claim 36.

44. (New) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound as recited in claim 37.

45. (New) A recording medium comprising a lubricant, which comprises a phosphorus-, perfluoropolyether-, and perfluoroalkyl-containing compound as recited in claim 38.